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**Payroll Taxes:
The Effects of Earnings Floors
on Part-time Employment**

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by

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July 1997

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Abstract

Payroll taxes that include earnings floors have two different effects on the level of part-time employment. The first, called the "income effect," is the result of an increase in payroll taxes on the global demand for workers. The second, called the "substitution effect," is the result of a change in the relative cost of part-time jobs in relation to full-time jobs on the hiring of part-time workers.

In this study, we attempted to answer the following questions: (1) To what extent did changes in premium rates and minimum earnings for the Unemployment Insurance Program, the Canada Pension Program, and the Quebec Pension Program have affected part-time employment in the 1980s?; and (2) What effect did the criterion of hours worked under the new Employment Insurance Program have on part-time employment? Accordingly, we have presented estimates of the impact of the increase in premium rates and minimum earnings of the three social programs from 1984 to 1993 on both part-time and full-time employment. We have also included estimates on the impact of the elimination of the premium floor for the new Employment Insurance Program on both categories of workers.

Our findings reveal a distinctive characteristic of the effect of payroll taxes on employment. Introducing or increasing payroll taxes with earnings floors can modify job quality. When such measures produce a variation in the cost of one type of worker in relation to another, there is a displacement in demand toward the less expensive type. Insofar as less costly jobs are occupied unwillingly, or are of poorer quality than more costly types of employment, either because of their remuneration, fringe benefits or instability, job quality changes.

The Employment Insurance Program, by doing away with minimum insurable earnings in order to cover part-time work, also eliminated the bias toward part-time work, thus helping to improve the quality of jobs in the economy.

Résumé

Les taxes sur la masse salariale qui comprennent des planchers de rémunération ont deux types d'effets sur le niveau d'emploi à temps partiel. Le premier effet, appelé "effet revenu", traduit l'effet de l'augmentation d'une taxe sur la masse salariale sur la demande globale de travailleurs. Le deuxième effet, appelé "effet substitution", traduit l'effet d'un changement du coût relatif des emplois à temps partiel par rapport aux emplois à temps plein sur l'embauche de travailleurs à temps partiel.

Dans la présente étude, nous tentons de répondre aux deux questions suivantes : (1) dans quelle mesure l'évolution des taux de cotisations et des planchers de rémunération du Régime d'Assurance-chômage, du Régime de Pension du Canada et du Régime des Rentes du Québec ont-ils influencé l'emploi à temps partiel au cours des années 1980 et (2) quelle est l'effet sur l'emploi à temps partiel de l'adoption du critère des heures dans le Régime d'assurance-emploi? Pour y répondre, nous présentons des estimations de l'impact de l'augmentation des taux de cotisations et des planchers de rémunération des trois programmes sociaux entre 1984 et 1993 sur l'emploi à temps partiel et à temps plein. Nous présentons également des estimations de l'impact de l'élimination du plancher des cotisations du nouveau Régime d'Assurance-emploi sur les deux catégories de travailleurs.

Les résultats illustrent une particularité de l'effet des taxes sur la masse salariale sur l'emploi. L'instauration ou l'augmentation d'une taxe sur la masse salariale avec plancher de rémunération peut modifier la qualité des emplois dans l'économie. Lorsque l'instauration ou l'augmentation d'une taxe sur la masse salariale produit une variation du coût d'un type de travailleur par rapport à un autre, il se produit un déplacement de la demande de travail vers le type de travail le moins coûteux. Dans la mesure où les emplois moins coûteux sont occupés involontairement, ou sont de moindre qualité que les emplois plus coûteux, soit à cause de leur rémunération, de leurs bénéfices marginaux ou de leur précarité, la qualité des emplois dans l'économie change.

Le Régime d'Assurance-emploi, en éliminant le minimum des gains assurables pour permettre la couverture du travail à temps partiel, élimine le biais en faveur du temps partiel et contribue ainsi à améliorer la qualité des emplois dans l'économie.

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1. Introduction

There has been a rapid growth in part-time employment in Canada over the last two decades. Between 1976 and 1995, part-time employment more than doubled, while full-time employment increased only by 28.5 percent.

The expansion of part-time work is partially explained by the changes caused by the shift to a highly urbanized, post-industrial society, as well as by technological and organizational change (HRDC (1994), Economic Council of Canada (1991)). For employers, these changes have led to alterations in the way their work is performed. Employers increasingly require a flexible workforce, particularly because of the introduction of new technologies, shortened production cycles, the growth in service activities and retail sales, the requirement to use a number of work shifts to optimize the utilization of machines and other costly production facilities and changes in consumption habits. For some workers, the growing participation by women in the labour market, the need to balance education and work, the aging of the population and the decline in the size of families, have all contributed to a growing preference for part-time work.

The expansion of part-time work also reflects certain aspects of the taxation system and, in particular, payroll taxes which may distort the allocation between part-time and full-time employment. For example, under the Unemployment Insurance Program, people with jobs providing them with less than 15 hours of work and \$163 per week (in 1995) with the same employer did not pay contributions. Certain employers took advantage of this provision by giving preference to jobs of 14 hours a week and less. This led to many workers working fewer hours in their principal employment than they would have wished. The Canada Pension Plan and the Quebec Pension Plan also include an earnings floor that is contribution exempt and is thus a contributing factor in encouraging employers to adopt this practice as a means of reducing their labour costs.

Under the new Employment Insurance Program, everyone pays contributions from the first hour of work, i.e. on each dollar earned, up to an annual maximum. The adoption of the hours criteria in the Employment Insurance Program should make it possible to reduce the incidence of involuntary part-time employment.

In this study, we will try to answer the following two questions: (1) to what extent did the developments relating to contribution rates and the earnings floor in these three social programs affect part-time employment during the 1980s and (2) what is the effect on part-time employment of the adoption of the hours criteria under the Employment Insurance Program? To answer these questions, we will present estimates of the impact of the increase in contribution rates and the earnings floor in the three social programs between 1984 and 1993 on part-time and full-time employment¹. We also present estimates of the impact of the elimination of the contribution floor under the new Employment Insurance (EI) Program on the two categories of employment.

An increase in the contribution rates for social programs affects the level of part-time employment in two ways. Firstly, it has an impact on part-time employment by affecting aggregate supply and demand for labour. Secondly, because it creates a gap between the costs of full-time and part-time jobs, it has an impact on the allocation of the overall work between part-time and full-time jobs. This gap is due to the earnings floors under the CPP/QPP and the UI Program. No contributions are paid below these floors. Thus, the proportion of the overall employment that will be allocated to part-time and full-time jobs will vary as a function of the trend line for this gap. An increase in the floor levels and/or contribution rates, will increase the gap between the costs of part-time as compared to full-time work, thus creating a distortion in the allocation of work, which encourages companies

¹ The year 1993 was selected because of the availability of data and the year 1984 to obtain a year similar to 1993 from the standpoint of its position in the economic cycle.

to replace full-time with part-time workers². The new EI Program, by abolishing the earnings floors to provide for the coverage of part-time work, will reduce the gap between the costs of a part-time and a full-time job and will, thus, contribute to reducing the incidence of involuntary part-time work.

The impact of raising contribution rates for the CPP/QPP and UI Program on part-time employment, thus, involves two effects: an income effect and a substitution effect. The income effect derives from the traditional impact on aggregate supply and demand. The income effect has an impact on part-time employment, by modifying the total quantity of labour demanded. The substitution effect derives from the change in the relative cost of part-time as compared to full-time work. The substitution effect does not have an impact on the total number of hours worked in total, but it does modify the allocation of the total labour between part-time and full-time employment. As there is a need for different quantities of part-time workers and full-time workers to work a given quantity of hours, the substitution effect has an impact on the number of people employed. Thus, the net effect on the number of people employed will depend on the extent of these two effects.

The methodology used for assessing the income effect consists of applying the labour demand and supply elasticities in a partial equilibrium model, to the rise in the contribution rates for the three social insurance programs between 1984 and 1993. The substitution effect is estimated by applying elasticities of substitution of full-time employment for part-time employment, to the differential in the gap between the cost of full-time employment and part-time employment attributable to the increase in contribution rates and earnings floors in the three programs between 1984 and 1993.

² Ceilings on CPP/QPP and EI contributions also have an impact on job duration. These ceilings encourage employers to use longer work weeks and have employees work overtime. These phenomena are not considered in this study.

The results of our estimates rely upon a series of assumptions and include error risks. Based on the assumptions used in this study, raising the contribution rates and the earnings floors in the CPP/QPP and the UI Program between 1984 and 1993 apparently had a positive effect on part-time employment in Canada. This result derives from the fact that the substitution effect was apparently more significant on part-time employment than the income effect. The rise in contribution rates reduced part-time employment via the income effect on aggregate labour supply and demand. The rise in contribution rates and the earnings floors also reduced the relative cost of part-time jobs as compared to full-time jobs. The reduction in the relative cost of part-time jobs apparently encouraged employers to replace full-time workers with part-time workers. The substitution effect was evidently so large that the number of part-time jobs increased after the rise in contributions and earnings floors.

These positive results on part-time employment, nevertheless, indicated the presence of a distortion in the allocation of employment between part-time and full-time jobs, which altered the quality of jobs in the economy. While the introduction or increase in a payroll tax with an earnings floor produces a variation in the relative cost of one type of worker as compared to another, it also produces a shift in labour demand towards the less costly type of labour. To the extent that the less costly jobs are occupied involuntarily or are of lower quality than the more costly jobs because of their pay, their fringe benefits or their precariousness, the quality of jobs in the economy changes and the overall well-being of society is reduced. The EI Program, by eliminating the minimum insurable earnings to allow for the coverage of part-time work, eliminates this bias in favour of part-time employment and thus contributes to improving the quality of jobs in the economy.

The rest of this document is organized as follows. Section 2 describes the analytical framework supporting our estimates. Section 3 presents estimates of the income effect of the rise in contribution rates on aggregate supply and demand for part-time and full-time employment. Section 4 presents an estimate of the variation in the relative cost of part-time as compared to full-time jobs, as well as estimates of the substitution effect and the net effect

of the rise in contribution rates and of earnings floors on the two categories of jobs. Section 5 presents estimates of the effect of eliminating the earnings floor in the Employment Insurance Program on the distribution of total jobs between part-time and full-time jobs. Section 6 provides the conclusions.

2. Analytical Framework

In traditional studies on the impact of payroll taxes on employment, the introduction or increase in a tax on payrolls increases the cost of labour for employers and reduces the quantity of labour demanded. This in turn induces a partial or equivalent reduction in after-tax salaries, whose extent is dependent on the degree of elasticity in the labour supply. If the labour supply is totally inelastic, the tax is completely absorbed by the workers. When the elasticities of labour supply and demand are known, the supply and demand models underlying these traditional studies can predict the employment effect of a rise in payroll taxes.

In the case of a payroll tax which includes an earnings floor below which no contribution is paid, raising that floor will have, in addition to the traditional effect on aggregate labour supply and demand, a substitution effect on workers subject to the tax in favour of workers exempted from the tax. The presence of an earnings floor causes the marginal cost of an hour of work to vary, depending on whether the salary of worker is below or above the floor. The employer does not have to pay contributions for a salary below the floor. Part-time work which would not be covered by social insurance programs, because of a salary that is too low and/or insufficient weekly hours of work may therefore become advantageous for an employer when compared to the hours worked by full-time workers who are subject to social insurance charges.

The theory predicts that an increase in the cost of one type of worker as compared to another will, under certain conditions, shift the labour demand towards the less costly worker³. Certain employers will therefore replace full-time workers with part-time workers based on the trend in the gap between the costs for the two types of labour. The replacement of full-time workers with part-time workers will have an impact on the number of part-time and full-time workers constituting the full workforce. Thus, the level of part-time and full-time

³ There has to be a certain measure of interchangeability between the types of workers.

employment will increase or decrease based on the trend in the relative cost of part-time work as compared to full-time work.

The impact on part-time employment of increasing a payroll tax, which includes an earnings floor, consists of two effects: an income effect and a substitution effect. The income effect derives from the traditional impact on aggregate labour supply and demand⁴. The substitution effect derives from changes in the relative costs for part-time as compared to full-time work. The substitution effect does not have an impact on the number of hours worked in total, but it does modify the allocation of the total quantity of labour between part-time and full-time. As there have to be different quantities of part-time and full-time workers to work a given quantity of hours, the substitution effect has an impact on the number of persons employed. Thus, the net effect on the number of persons employed will depend on the extent of the two effects.

The income and substitution effects of introducing or increasing a payroll tax with an earnings floor, may be analysed using the analytical framework shown in Figure 1.

⁴ In this study, we adopt the standard hypothesis that the elasticities of labour supply and demand can be calculated independent of the benefits linked to the program that these taxes help to finance. Archambault and Hostland (1996) suggest that this is not necessarily the case.

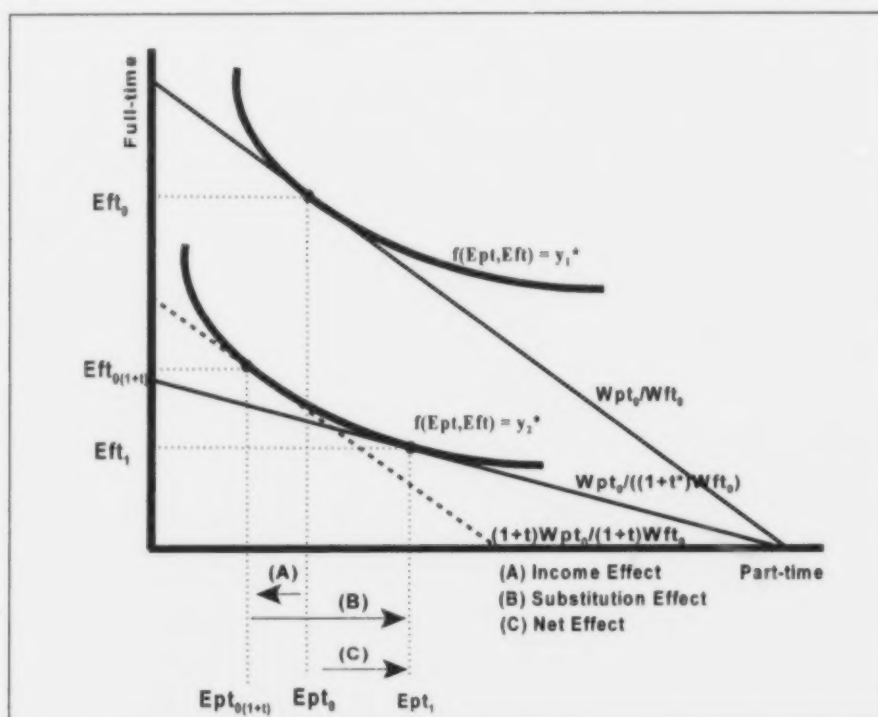


Figure 1

Our model includes two types of worker: part-time workers and full-time workers. Firms choose the combination of part-time jobs and full-time jobs, which maximizes their production subject to a given function of their weekly costs. In the absence of taxes or variations in payroll taxes, the weekly costs of part-time and full-time jobs are W_{pt0} and W_{ft0} , respectively. Given these costs, firms hire E_{pt0} part-time workers and E_{ft0} full-time workers and produce y_1^* . A payroll tax is introduced at rate " t " which is applicable to the entire payroll expenditure. Over the short to medium term, the introduction of the tax results in an increase in labour costs. The costs for the part-time and full-time workers increase to $(1+t)W_{pt0}$ and $(1+t)W_{ft0}$, respectively. At the new increased labour costs, firms reduce their part-time staff by $(E_{pt0} - E_{pt0(1+t)})$ and their full-time staff by $(E_{ft0} - E_{ft0(1+t)})$ and produce y_2^* . The introduction of a tax applicable to the entire payroll produces an income effect which

translates into a reduction in part-time and full-time employment. This result corresponds to the predictions of traditional models of labour supply and demand.

We now introduce an earnings floor below which employers do not have to pay any contributions and assume that the effect of this floor is to exempt all part-time workers from payroll taxes. In exchange, the tax rate is raised for all other workers to t^* to ensure that the tax generates the same level of receipts as before the introduction of the earnings floor. The effect of the floor is to bring down the cost of part-time work back to Wpt_0 , while the cost of full-time work increases to $(1+t^*)Wft_0$. The change in the relative back prices caused by the exemption of part-time workers from the payroll tax and the rise in the rate of the tax to t^* have the effect of encouraging employers to change the allocation of the quantity of labour required to produce y_2^* by substituting part-time for full-time workers. In Figure 1, this effect is displayed by a substitution of $(Eft_{0(1+t)} - Eft_1)$ full-time workers for $(Ept_1 - Ept_{0(1+t)})$ part-time workers. The net effect of introducing a payroll tax with an earnings floor is a reduction in full-time employment of $(Eft_0 - Eft_1)$ and an increase in part-time employment of $(Ept_1 - Ept_0)$.

3. Estimates of the Income Effect

The income effect on part-time employment of introducing or raising a payroll tax with an earnings floor derives from the traditional impact of the tax on the aggregate labour supply and demand. To estimate this income effect, we are using a simple partial equilibrium model where labour supply and demand are represented as follows: ⁵

$$L_d = f(w[1+\tau]); \quad (1)$$

$$L_s = g(w), \quad (2)$$

where w is the salary paid, τ is the payroll tax as a percentage of salary. At an equilibrium $L_d = L_s$, or

$$f(w^*(1+\tau)) = g(w^*) \quad (3)$$

where $(^*)$ indicates the value of the equilibrium in salaries. By differentiating the equation with respect to the tax rate on the payroll expenditure, and processing the result to express it in logarithm form, we obtain

$$\partial \ln w^* / \partial \tau = E_d / (E_s - (1+\tau)E_d) \quad (4)$$

where, E_d is the elasticity of labour demand, E_s is the elasticity of labour supply. The impact on the employment equilibrium of a variation in the payroll tax may, thus, be expressed as follows:

$$\partial \ln L = \partial \tau E_d [1 + (E_d / (E_s(1+\tau)^{-1} - E_d)] \quad (5)$$

When $\tau = 0$, the effect of the raise in the payroll tax on the employment equilibrium may easily be interpreted for the following two extreme cases. In the first case, the labour supply in the economy is completely inelastic, $E_s = 0$. In this case, the effect of raising the payroll tax will not have any effect on the employment equilibrium level and will produce a corresponding decrease in the salary level equilibrium. In the second case, the labour supply

⁵ This simple partial equilibrium model is drawn from Hamermesh 1994.

is completely elastic, $E_s = \infty$. In this case, the effect on the employment equilibrium level is equal to the value of the elasticity of the labour demand multiplied by the percentage increase in the payroll tax, while there will be no effect on the salary equilibrium level. In general, however, the impact of a change in a payroll tax depends both on the value of the elasticity of the demand for labour and the elasticity of the labour supply.

A simple approach for predicting the impact on employment of an increase in a payroll tax consists of making the assumption that the increase in the tax will generate a proportional reduction in employment and, hence, to combine the best possible estimate of the elasticity of the labour demand with the best possible estimate of the elasticity of the labour supply. According to Hamermesh (1994), a value of -0.4 is probably the best possible estimate of the elasticity of the labour demand. With regard to the elasticity of the labour supply, Phipps (1993) concluded that the labour supply was inelastic. Heckman (1993), for his part, concluded that estimates of the labour supply based on employment, were definitively positive and higher than estimates based on hours. We have chosen a range of elasticities of the labour supply of 0.1 to 0.3, on the basis of recent studies which produced estimates of the impact on employment of a rise in payroll taxes [Italiano (1995), Grignon (1994)].

The contributions by employers and employees to the CPP/QPP and the UI Program grew from 5.98 percent of wages and salaries in 1984 to 8.95 percent in 1993, an increase of 2.97 percentage points⁶. Given the elasticities for labour demand and supply used, the increase of 2.97 percentage points in contribution rates had the effect of reducing total employment by 0.2 to 0.5 percent, i.e. a loss of 26,000 to 56,000 jobs. The effects on part-time and full-time employment are set out in Table 1. On the basis of the share of part-time employment in total employment for 1984 (16.8%), the income effect of raising the contribution rates for the three programs between 1984 and 1993 translated into a loss of 4,000 to 9,000 part-time jobs and 22,000 to 47,000 full-time jobs.

⁶ Data on CPP/QPP and UI Program contributions are from Cansim, matrix 6677. Data on wages and salaries are from Cansim, matrix 808.

Table 1 Income Effect Under Different Elasticities for Labour Supply

E_s	$E_s = 0.1$	$E_s = 0.2$	$E_s = 0.3$
Part-time Jobs	-4,000	-7,000	-9,000
Full-time Jobs	-22, 000	-36, 000	-47,000

4. Estimates of the Substitution Effect

The substitution effect from full-time to part-time work derives from the change in the relative cost of part-time work in relation to full-time work. The methodology that we use to measure the impact of raising contribution rates for the UI Program and the CPP/QPP on part-time employment, includes two stages: (1) estimating the variation in the relative cost of part-time jobs as compared to full-time jobs attributable to the increase in contribution rates and earnings floors; and (2) estimating the impact of the change in relative costs on part-time and full-time work.

4.1 Estimate of the Variation in the Relative Costs for Part-time Jobs

The labour costs considered in this document include wages and salaries and contributions to CPP/QPP and the UI Program. We did not take into account the other costs to employers associated with a health or pension plan, nor employee training costs. To estimate the costs of part-time and full-time work, we required information on contributions to the three social insurance programs, as well as on the wages and salaries of part-time and full-time workers. In this document we calculated the costs of the two types of workers on a weekly basis.⁷

The weekly costs of part-time and full-time jobs were calculated by dividing the amount of wages and salaries and contributions to the three programs by part-time and full-time workers by the number of hours actually worked by the two categories of workers. To calculate the wages and salaries of part-time workers we made the assumption that the share of wages and salaries of part-time workers was proportional to the share of weekly hours actually worked part-time and that part-time workers were paid 78.7% of the average hourly wage of workers

⁷ We have estimated the costs on a weekly basis, because the weekly hours actually worked as drawn from Statistics Canada's Labour Force Survey represent, as far as we are aware, the only available source of data which divides the hours into part-time and full-time.

overall⁸. The contributions of part-time workers for jobs under the three programs were estimated in the same way but took into account the minimum earnings levels for the three programs. To do this, we restricted the share of contributions for part-time jobs to part-time workers who actually paid contributions to the three social insurance programs⁹. Based on the data from Statistics Canada's Social Policies' Simulation Model, the proportion of part-time workers who did not contribute to either the CPP/QPP or the UI Program grew from 26.6% in 1984 to 29.8% in 1993. This increase was largely attributable to the raising of the earnings floors under the three programs. The wages and salaries and the contributions to the three programs, by full-time workers, were obtained as residuals.

Table 2 presents the estimates for 1984 and 1993 of the weekly costs of part-time and full-time jobs and the relative costs of part-time jobs as compared to full time jobs.

Table 2 Weekly Costs for Part-time and Full-time Jobs and the Relative Costs of Part-time as Compared to Full-time Jobs

	Part-time Jobs	Full-time Jobs	Ratio Part-time/Full time in Percentage
1984	\$423.65	\$585.49	72.4
1993	\$612.17	\$858.42	71.3

⁸ The wages and salaries of part-time workers are calculated by multiplying the total wages and salaries by the share of weekly hours actually worked part-time and by the ratio of the hourly wage of part-time workers to the hourly wage of all workers. In 1984 and 1993, part-time workers worked 7.42% and 8.82%, respectively, of the total weekly hours worked in those two years. According to the Statistics Canada 1988 Labour Market Activity Survey, the average hourly wage of part-time workers was \$8.91, and the average hourly wage of all workers was \$11.32.

⁹ The insurable earnings of part-time workers corresponds to the wages and salaries of part-time workers (i.e., total wages and salaries multiplied by 78.7%) multiplied by 1 less the share of part-time workers who did not contribute to any of the three plans. Contributions are calculated by applying the ratio of the insurable earnings of part-time workers over total earnings to total contributions.

As is shown in Table 2, the weekly cost of part-time jobs is lower than the weekly cost of full-time jobs. This is explained by the fact that the average weekly earnings for part-time workers are lower than those of full-time workers and also because the weekly earnings for part-time jobs are generally lower than the minimum levels for contributions to the three programs. Below the minimum levels the weekly earnings for part-time jobs are not subject to contribution.

The weekly costs for part-time and full-time jobs amounted to \$423.65 and \$585.49 for the two respective job categories in 1984. The weekly costs to employers for part-time jobs therefore represented 72.4 percent of the weekly costs for full-time jobs. The weekly costs for part-time workers, between 1984 and 1993, rose 44 percent to \$612.17, but the weekly cost for full-time workers rose even more to \$858.42, so that the relative costs for part-time jobs decreased by 1.4 percent to stand at 71.3 percent of the costs for full-time jobs.

However, the relative decline in the relative costs for part-time jobs attributable to raising the contribution rates and the minimum earnings levels was only 1.0 percent, because 0.4 percent of the reduction in the relative costs for part-time jobs was due to a relative increase in the average weekly hours worked part-time, to a relative reduction in their pay, or to both.¹⁰

The 1.0 percent drop in the relative costs for part-time as compared to full-time jobs represents the reduction in the costs for part-time as compared to full-time work attributable to the increase in contribution and earnings floors under the CPP/QPP and the UI Program between 1984 and 1993.

¹⁰ In fact, if we exclude the contributions to the three social insurance programs, the weekly costs for part-time jobs (i.e. wages and salaries) declined by 0.4% between 1984 and 1993. This rise can, therefore, not be attributed to raising contribution rates for the social insurance programs.

4.2 Estimates of the Impact of the Variation in the Relative Costs on Part-time Employment

The impact of the variation in the relative cost of part-time jobs on part-time employment is obtained by applying the elasticities of substitution of full-time jobs for part-time jobs, to the relative reduction in the costs for part-time jobs.

We have inventoried three empirical studies which estimated elasticities of substitution of full-time jobs for part-time jobs. The three studies are American and obtain substitution elasticities of full-time jobs for part-time jobs following an increase in the relative wages paid for full-time as compared to part-time work of 4.35 [Owen (1979)], 0.21 [Ehrenberg, Rosenberg, and Li (1988)], and 0.67 [Montgomery (1988)].

According to Hamermesh (1994), the Montgomery study (1988) provides the best results, because the author's micro-data factors in the possibility of an endogenous labour supply (i.e. that the labour supply also responds to changes in contribution rates). The Montgomery results indicate that an increase of 1% in wages for full-time work relative to those for part-time work will increase the proportion of part-time work in the overall total employment by 0.67 percent (see the chart in the Appendix). Since the Montgomery study is American, we cannot be sure that it would be appropriate in a Canadian context. Given this fact, as well as the scarcity of the literature on the topic (mainly attributable to the scarcity of data on the demand for labour side of the equation), it is prudent to include a margin of error to Montgomery's estimate of the substitution elasticity. For these reasons, we have chosen to use substitution elasticities (E_{fpt}) of 0.5, 0.67 and 1.0.

4.2.1 Effect on the Proportion of Part-time Employment

To estimate the impact of an increase in contribution rates and earnings floors for the CPP/QPP and the UI Program on the proportion of part-time employment between 1984 and 1993, we applied the three substitution elasticities involved in substituting part-time jobs for full-time jobs to the reduction in the relative costs for part-time jobs attributable to the

increase in contribution rates and earnings floors (1 percent between 1984 and 1993). Our results indicate that the decline of 1 percent in the relative cost of part-time jobs was apparently a contributing factor in increasing the proportion of part-time work by 0.5, 0.67 and 1.0 percent between 1984 and 1993.¹¹

4.2.2 Effect on the level of part-time employment

The substitution effect does not have an impact on the total number of hours worked but does, however, modify the allocation of the total quantity of labour between part-time and full-time. As there is a need for different numbers of part-time and full-time workers to work a given number of hours, the substitution effect has an impact on the number of persons employed.

To translate the effect of the reduction in the relative costs of part-time jobs on the proportion of part-time employment in levels of part-time jobs, we must take into account the number of part-time workers required to replace a full-time worker. A problem arises here based on the fact that the definition of employment in the Labour Force Survey corresponds to the number of persons employed, whose principal employment is either part-time or full-time. In practice, the number of jobs, or the total quantity of labour demanded, is higher than the number of persons employed, because of the people who have several jobs. As a result, the substitution effect on the number of part-time jobs may be higher than the substitution effect on the number of people employed whose principal job is part-time.

To take into account the phenomenon of multiple jobs, we have used the average weekly hours worked in all jobs to calculate a part-time/full-time equivalency factor. We have made the assumption that the part-time and full-time workers are substitutes for each other and that

¹¹ The proportion of part-time employment within the overall employment grew from 16.77% in 1984 to 19.02% in 1993, an increase of 2.28 percentage points. The share attributable to the increase in contribution rates and the earnings floors is 0.08, 0.11 and 0.17 percentage points based on using a substitution elasticity of 0.5, 0.67 and 1.0 respectively.

the number of part-time workers required to replace a full-time worker is equal to the ratio of average weekly hours worked in all jobs for the two categories of workers. Based on the 1984 data, a part-time worker worked 40 percent of the average weekly hours worked by a full-time worker (a part-time worker worked an average of 15.3 hours per week in 1984 as compared to the 38.5 hours worked by a full-time worker). We have assumed, therefore, that a part-time worker was equivalent to 0.4 percent of a full-time worker, or, conversely, that 2.5 part-time workers are required to replace a full-time worker.

To calculate the impact of a reduction in the relative costs on the level of part-time jobs, we need to solve the following problem: by how much must part-time employment increase and full-time employment decrease, in order for the proportion of part-time employment in the total employment to increase from $x\%$ to $y\%$, assuming that a part-time worker replaces 0.4 of a full-time worker?

As we know the initial values for part-time and full-time employment, the equivalency factor for part-time/full-time jobs and the proportion of part-time employment within the overall employment to be reached, we can resolve our problem by solving the following equation:¹²

$$(1) \Delta Pt = x^* (Pt + Ft) - Pt / (1 - 0.6x^*)$$

where ΔPt is the variation in the level of part-time jobs, x^* is the proportion of part-time employment of the total employment to be reached, Pt and Ft , are, respectively, the initial levels of part-time and full-time jobs. Appendix 2 of this document describes the solution of the problem in detail.

¹² The effect of using average weekly hours worked in all jobs instead of average weekly hours worked in the principal job is to reduce the number of jobs required for the proportion of part-time jobs to increase from $x\%$ to $y\%$ in equation (1). Using the hours worked in all jobs results in an equivalency of 0.40 full-time to part-time jobs, rather than 0.39 when we use principal jobs alone. The ratio of hours worked in all jobs being higher than that of hours worked in the principal job only, the denominator of equation (1) is greater and the solution to the equation for a proportion of the given part-time employment provides a lower number of part-time jobs than if we use the ratio of weekly hours worked in the principal job.

On the basis of the levels of part-time and full-time jobs in 1984, the results from the previous section and from equation (1) above, we estimate in Table 3 that raising contribution rates and earnings floors for the CPP/QPP and the UI Program between 1984 and 1993 apparently encouraged employers to replace 4,000 to 8,000 full-time jobs by 10,000 to 20,000 part-time jobs, depending on the substitution elasticities used. The 10,000 to 20,000 additional part-time jobs represented between 1.8 and 3.4 percent of net part-time job creation between 1984 and 1993. However, in terms of full-time equivalents or total hours worked, the substitution effect did not modify the total quantity of work demanded, it merely redistributed the available employment between part-time and full-time jobs. On the other hand, because the replacement of the hours worked by one full-time person required 2.5 part-time persons, overall, the substitution effect resulted in employers using from 6,000 to 12,000 additional persons to perform the available quantity of work.

Table 3 Substitution Effect Based on Different Substitution Elasticities

E_{fpt}	$E_{\text{fpt}} = 0.5$	$E_{\text{fpt}} = 0.67$	$E_{\text{fpt}} = 1.0$
Effect on Part-time Employment	+10,000	+14,000	+20,000
Effect on Full-time Employment	-4,000	-6,000	-8,000

4.3 The Net Effect on Part-time Employment

Table 4 combines the results from Tables 1 and 4 for different elasticities of labour supply and demand and the substitution elasticities used in the study. These results correspond to the combined net effect of raising contribution rates and earnings floors on part-time and full-time employment. In Table 1 for example, for an elasticity of labour supply of 0.1, the net income effect of the 2.97 percentage point rise in contribution rates between 1984 and 1993 was a loss of 4,000 part-time and 22,000 full-time jobs. In Table 3, the substitution effect for a substitution elasticity of 0.5 was an increase of 10,000 part-time jobs and a reduction of 4,000 full-time jobs. In Table 4, for an elasticity in the labour supply of 0.1 and a substitution

elasticity of 0.5, the net combined effect corresponds to the sum of the results of Tables 1 and 3, i.e. a net gain of 6,000 part-time jobs and a net loss of 26,000 full-time jobs.

Table 4 Net Effect on Part-time and Full-time Employment of Raising Contribution Rates and Earnings Floors for the CPP, QPP and UI Program between 1984 and 1993

E_s	$E_s=0.1$			$E_s=0.2$			$E_s=0.3$		
	$E_{npt}=0.5$	$E_{npt}=0.67$	$E_{npt}=1.0$	$E_{npt}=0.5$	$E_{npt}=0.67$	$E_{npt}=1.0$	$E_{npt}=0.5$	$E_{npt}=0.67$	$E_{npt}=1.0$
Part-time Jobs	+6,000	+10,000	+16,000	+3,000	+7,000	+13,000	+1,000	+5,000	+11,000
Full-time Jobs	-26,000	-28,000	-30,000	-40,000	-42,000	-44,000	-51,000	-53,000	-55,000
Full-time Equivalent Jobs	-24,000	-24,000	-24,000	-39,000	-39,000	-39,000	-50,000	-50,000	-50,000

A summary of the results of the two effects follows. In the absence of earnings floors, raising contribution rates for the three social programs by 2.97 percentage points between 1984 and 1993 would not have changed the relative costs of part-time as compared to full-time jobs and the income effect on employment would have translated, all other things being equal, into a loss of 4,000 to 9,000 part-time jobs and of 22,000 to 47,000 full-time jobs. These results correspond to the predictions of traditional labour supply and demand models and are comparable to the results reported in the literature for equivalent assumptions on the elasticities of supply and demand for labour [Weldon (1993), Marchildon, Sargent and Ruggeri (1995)]. Over and beyond the traditional income effects, we have established that raising the earnings floors and contribution rates had produced a relative drop in the cost of part-time jobs as compared to full-time jobs, which was estimated as being 1.0 percent between 1984 and 1993. This drop apparently translated into 4,000 to 8,000 full time jobs being replaced by 10,000 to 20,000 part-time jobs. This result has not generally been taken

into account in traditional studies on the employment impacts of payroll taxes. The net effects reported in Table 4 are therefore not comparable to results from traditional studies.

Based on the elasticities used, Table 4 shows that the combined results of the two effects was a net gain of 1,000 to 16,000 part-time jobs and a net drop of 26,000 to 55,000 full-time jobs. In terms of percentage in relation to levels of jobs in 1984, the higher limits of the results imply an increase of 0.8 percent in part-time employment and a reduction of 0.6 percent in full-time employment. The net raise in the part-time employment attributable to the two effects of payroll taxes corresponds to about 3.0 of the net job creation in part-time jobs during the 1984 to 1993 period.

We should note, however, that because the substitution effect does not modify the total quantity of labour demanded, the total net effect of raising contribution rates and earnings floors in terms of full-time equivalent jobs or the total hours worked, is more significant than the sum of the net effects on part-time and full-time employment. In fact, when we translate the net effects on part-time employment into full-time equivalent jobs, the loss of jobs caused by raising the contribution rates and earnings floors for the three social insurance programs is somewhere between 24,000 and 50,000 full-time equivalent jobs.

5. Elimination of the Earnings Floor in the EI Program

On December 1, 1995, the Honorable Lloyd Axworthy, Minister of Human Resources Development Canada, tabled, in the House of Commons, the text of a New Employment Insurance (EI) Program. Under this new EI Program, the weekly floors and ceilings for contributions were eliminated as of January 1, 1997, with the introduction of a system based on hours. Employers and employees now pay contributions starting with the first dollar earned, up to an annual maximum of insurable earnings of \$39,000.

The new contribution structure will have an impact on the costs for part-time and full-time jobs in two ways. First, the elimination of the earnings floor will result in raising the costs for part-time jobs, since each dollar earned will be subject to contributions. Secondly, the replacement of the weekly maximum by an annual maximum of insurable earnings will result in a reduction in the costs for full-time jobs, because the new annual maximum of insurable earnings is lower than the weekly maximum under the current system, which is from \$815 to almost \$42,380 per year. No contribution will be paid on earnings above the new annual maximum of \$39,000.

Using the methodology set out in section 4, we can calculate an estimate of the substitution effect of eliminating the weekly minimum of insurable earnings for part-time and full-time employment. On the basis of 1993 data, the elimination of the weekly minimum of insurable earnings would translate into a rise of 1.8 percent in the relative costs of part-time employment¹³. The EI contribution rates would apparently be identical for the two categories

¹³ The weekly costs for part-time jobs would go from 71.3% of the weekly costs of full-time jobs under the UI Program to 72.6% with the elimination of the weekly minimum of insurable earnings under the EI Program. The weekly costs of part-time jobs after the elimination of the weekly minimum of insurable earnings is calculated using the methodology described in section 4.1, but omitting the portion of part-time workers who have not contributed to any of the three plans when calculating the EI Program contributions of part-time workers. This estimate is approximate as it does not take into account the replacement of the weekly maximum insurable earnings with a lower annual maximum or the drop in the contribution rate from 2.95% to 2.90 % of the \$100 of insurable earnings in 1997.

of workers (at 5.4 percent of wages and salaries for the two categories of workers)¹⁴.

However, the weekly costs for part-time jobs would continue to be below the weekly costs for full-time employment because of the lower average weekly salaries for part-time jobs and the earnings floors for the CPP/QPP.

On the basis of the elasticities of substitution of full-time jobs for part-time jobs used, the rise of 1.8 percent in the relative costs for part-time work as a result of the elimination of the earnings floor under the EI Program would apparently result, all other things being equal, in a drop in the share of part-time work in the order of 0.9 to 1.8 percent. In terms of jobs, Table 5 shows that this drop might translate into a substitution of 20,000 to 40,000 part-time jobs for 8,000 to 16,000 full-time jobs¹⁵. The elimination of the earnings floor under the EI Program does not change the number of hours worked in the economy, as can be seen in the line item "Full-time Equivalent Jobs", which shows the net effect on employment in terms of hours worked. This eliminates a labour market distortion which had an artificial effect on the allocation of the available quantity of labour between part-time and full-time work.

Table 5 Substitution Effect of Eliminating the Earnings Floor Under the EI Program Based on Different Substitution Elasticities

E_{npt}	$E_{npt} = 0.5$	$E_{npt} = 0.67$	$E_{npt} = 1.0$
Effect on Part-time Employment	-20,000	-28,000	-40,000
Effect on Full-time Employment	+8,000	+11,000	+16,000
Full-time Equivalent Jobs	0	0	0

¹⁴ In reality, the EI contribution rate for part-time jobs will be higher than the contribution rate for full-time jobs because of the annual maximum of insurable earnings of \$39,000. Because earnings from part-time jobs will be almost entirely insurable and because only a portion of earnings from full-time jobs will be insurable, the effective average EI contribution rate for part-time jobs will be higher than that for full-time jobs.

¹⁵ The part-time/full-time job equivalence factor for 1993 is 0.41.

6. Conclusions

In this study, we have tried to answer the following two questions: (1) to what extent did the developments relating to contribution rates and minimum earnings levels in the Canada Pension Plan, the Quebec Pension Plan and the Unemployment Insurance Program affect part-time employment during the 1980s and (2) what is the effect on part-time employment of the adoption of the hours criteria under the Employment Insurance Program? To answer these questions, we have presented estimates of the impact of the increase in contribution rates and the earnings floor under the three social programs between 1984 and 1993 on part-time and full-time employment. We have also presented estimates of the impact of eliminating the contributions floor under the new Employment Insurance (EI) Program on the two categories of jobs.

Raising contribution rates under the three programs has an impact on the level of part-time jobs via the aggregate effect on labour supply and demand and via a substitution effect caused by a variation in the relative costs for one type of worker as compared to another. The substitution effect is due to the earnings floors under the CPP/QPP and the UI Program, which creates a gap between the costs for a full-time and a part-time job. The earnings floors create a labour market distortion by changing the allocation of workers between part-time and full-time jobs.

The results of our estimates depend on a series of assumptions and include error risks. For example, the results depend, to a large extent, on the empirical values of the elasticities of labour supply and demand that we have used, as well as the value and relevance in the Canadian context of the elasticity of substitution of full-time work for part-time work as estimated by Montgomery.

According to our estimates, the increase in contribution rates and earnings floors under the CPP/QPP and the UI Program may have contributed to increasing by 1,000 to 16,000 the

level of part-time jobs between 1984 and 1993. Because of the presence of earnings floors, the substitution effect of the rise in contributions on part-time employment was apparently more significant than the income effect. The presence of earnings floors in the three programs has reduced the relative costs for part-time jobs and this has encouraged employers to redistribute the quantity of labour available between full-time and part-time workers. The net effect has been to counterbalance the loss of part-time jobs caused by the rise in contribution rates.

These positive results for part-time employment indicate, however, the presence of a distortion in the allocation of employment between part-time and full-time employment, which has changed the quality of jobs in the economy. When the introduction or increase in a tax results in a variation in the relative costs of one type of worker as compared to another, it leads to a shift in the labour demand towards the less costly type of labour. To the extent that the less costly jobs are occupied involuntarily, or are of a lower quality than the more costly jobs, because of their salary levels, their fringe benefits or their precariousness, the quality of jobs in the economy changes.

For its part, the elimination of the earnings floor under the new EI Program is contributing to improving the quality of jobs in the economy, by eliminating an artificial source for the gap between the costs of part-time jobs and the costs of full-time jobs. This reform should be reflected in a reduction in the proportion of part-time employment within the total employment picture.

Appendix 1

Elasticity of Substitution of Part-time Workers for Full-time Workers According to Montgomery

Montgomery (1988) presents an empirical assessment of the factors determining the proportion of employees who are part-time workers. Regression analyses are used to examine the effect of the company's characteristics on part-time workers (E_{pt}) as a percentage of the entire group of employees (E) of the company. The data used derives from a survey conducted with 4,519 companies in 28 geographic sites by the "Institute of Research on Poverty" at the University of Wisconsin.

Montgomery's regression analysis model, which is estimated by the Ordinary Least Squares (OLS) is the following:

$$E_{pt}/E = \alpha_0 + \alpha_1 \text{ Wage} + \alpha_i X_i$$

Where:

E_{pt} is the number of part-time employees within the organization;

E is the total employment level within the organization;

Wage is the ratio of the part-time workers salaries to the salaries of full-time workers; and

X_i represents the other independent variables included in the regression.

In our estimates of the impact of payroll taxes on the proportion of part-time employment, we use the elasticity of E_{pt}/E in relation to Wage , which, as reported by the author, assumes the value of -0.67. The elasticity of substitution of full-time workers for part-time workers in relation to salary may be represented by the following expression:

$$\rho = \frac{\frac{d(E_{pt}/E)}{d(Wage)} \cdot (Wage)}{(E_{pt}/E)} = -0.67$$

where E_{pt} is the number of part-time jobs, " E " is the total employment level, and " Wage " is the relative cost of part-time jobs in relation to full-time jobs.

Appendix 2

Methodology for Calculating Levels of Part-time/Full-time Jobs

The methodology outlined below is used in Section 4.2 for calculating the variation in part-time and full-time employment which is required to arrive at a proportion of the part-time employment in the given total employment. The calculations are based on the known initial values.

The calculations below rest on the assumption that part-time and full-time workers are perfect substitutes for each other and that the number of part-time workers required to replace a full-time worker is equal to the ratio of average weekly hours worked by the two categories of workers. Based on the average weekly hours worked part-time and full-time in 1984, a part-time worker worked 40% of the average weekly hours of a full-time worker (see the table below). It is therefore assumed that a part-time worker replaces 0.4 of a full-time worker, or conversely, that 2.5 part-time workers are required to replace a full-time worker.

Average Weekly Hours Actually Worked by Part-time and Full-time Workers in 1984

Part-time Workers	Full-time Workers	All Workers
15.3 hrs/week	38.5 hrs/week	34.6 hrs/week

Equation (1) is therefore as follows:

$$(1) \Delta Ft = 0.4 \Delta Pt, \text{ where,}$$

ΔFt represents the variation in the level of full-time employment and ΔPt is the variation in the level of part-time employment.

For known levels of part-time and full-time jobs, we calculate the proportion of part-time employment in the total employment, x , as follows:

$$(2) \quad Pt / (Pt + Ft) = x$$

If it is assumed that a variation in the relative costs of part-time as compared to full-time jobs which would cause the proportion of part-time employment to rise from x to x^* . The new proportion of part-time employment in the total employment is calculated as follows:

$$(3) (Pt + \Delta Pt) / [(Pt + \Delta Pt) + (Ft - \Delta Ft)] = x^*$$

Appendix 2 (Continued)

As the levels of part-time and full-time employment (P_t and F_t) and the value of x^* are known, equation (1) can be used to replace ΔF_t in equation (3) and solve equation (3) for ΔP_t (see box below). In this way, equation (4) is obtained which indicates the variation in the level of part-time work which is required to rise from x to x^* . Since ΔP_t is known, the variation in the level of full-time employment involving the variation in ΔP_t is calculated using equation (1).

$$(4) \Delta P_t = x^* (P_t + F_t) - P_t / (1 - 0.6x^*)$$

Solution of equation (3) for ΔP_t .

$$(3) \quad (P_t + \Delta P_t) / [(P_t + \Delta P_t) + (F_t - \Delta F_t)] = x^*$$

$$P_t + \Delta P_t = x^* [(P_t + \Delta P_t) + (F_t - 0.4\Delta P_t)]$$

$$P_t + \Delta P_t = x^* [(P_t + F_t) + (1 - 0.4)\Delta P_t]$$

$$P_t + \Delta P_t = x^* [P_t + F_t + 0.6\Delta P_t]$$

$$P_t + \Delta P_t = x^* (P_t + F_t) + 0.6x^*\Delta P_t$$

$$(1 - 0.6x^*)\Delta P_t = x^* (P_t + F_t) - P_t$$

$$(4) \quad \Delta P_t = x^* (P_t + F_t) - P_t / (1 - 0.6x^*)$$

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